BCS FIRE MISSION PROCESSING

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FIRE MISSION PROCESSING

- <u>**Basic fire mission processing~>**</u>
- **Step 1: Specify target location**
- **Step 2: Enter fire order/mission specific data**

- <u>**BCS Special Situations~>**</u>
- **Unique formats/processing actions maybe required by BCS**

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BCS MAIN INDEX

P. 3-12

- **Main point for entering the system**

```
SYS;INDEX;C:___;
  1:INPUT QUEUE
  2:MESSAGE SKELETONS
  3:DATA BASE
  4:FIRE PLANS                    _ OF 4
  5:SYSTEM SETUP/SUBSCRIBERS    __ OF 72
  6:SYSTEM WARNINGS             __ OF 12
  7:FIRE PLAN GROUP ENTRY
  LAST DATA BASE RECORDING      __/___/__ __/__/__ (_)
  TARGET NUMBER BLOCK           _____/___
  NEXT TARGET NUMBER            _____
SELECT:__;
```

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MESSAGE SKELETONS

p. 3-15 to 3-16

- **Allows the operator to select a blank format**

```
SYS;MSGSUM;C:__;
```

1:FM;CHECK	10:AFU;AMMO	20:HOW;UPDATE
2:FM;CFF	11:AFU;MASK	21:HOW;AMOUP
3:FM;SUBS	12:AFU;REG	22:HOW;REQUST
4:FM;NUKE	13:BCS;MMD	23:HOW;MOVE
5:FM;INIM	14:BCS;COMD	24:HOW;OBSR
6:FM;QF	15:SPRT;BGECM	25:ATI;AZR
7:FM;FOCMD	16:SPRT;ZNE	26:ATI;CDR
8:FM;OBCO	17:SPRT;LOC	27:ATI;SHR
9:FM;MTO	18:NNFP;CFF	28:SYS;PIM
	19:MET;CM	29:SYS;RING

```
SELECT:__;
```

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GUNNERY DEPARTMENT

FM;CFF:_;TGT:_____;KNPT:__;CORD:_____/_____/_____;GZ:___;RV:___;
OB:__;FST:__;DIR:____/__;DIST:____;SHIFT:_/____/_/____/_/____;
LAS:____;TYPE:_____/_____;DOP:_____;SIZE:____/____;ATT:___;
CONT:____/____;ME:____/___;TIME:__/__;MIS:_;PRI:_;PTM:_____;
ASF:___/____;SH:___/___;FZ:____/____;RDS:__;VOL:__;STR:____;
EOM:_;RAT:_;ASNFPF:_;UFFE:_/_/_/__/___,_/_/_/_/__/___
LOT:_/_;CHG:_;LOTS:_/_/_;CHGS:_/_;FIRINT:___;
PTF:____;SPTF:__/_/_/__;SHTF:_/_/_/_/_/_/_;
PFFE:____;SHFFE:_/_/_/_/_/_/_;
HOB:____;RG:_____;TOF:___._;MAXORD:_____;
SHEAF:____;VOLCMD:_;CSLOAD:_;RPT:_;

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TIME ON TARGET

HOW BCS WILL COMPUTE THE TIME TO FIRE:

	TOT
-	**(TOF + 5)**
=	**BCS Time to fire**

*Calculations based on BCS system time

**BCS will not allow you to execute if outside 10 minutes from TOT (or after specified TOT time)

***BCS uses countdown clock in upper display to track

****BCS will xmit "fire" to GDUs at 0 (if F8 pressed x2)

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BALLISTIC PROCESSING

p. 5-3

- **Blank fields trigger selection routines**
- **BCS ballistic processing sequence (p. 5-4)**
  - **(1) Ammunition Components Selection**
  - **(2) Ballistic Preparation (p. 5-7 Charge Selection)**
  - **(3) Ballistic Solution**

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FFE PROJECTILE SELECTION

EXAMPLE:

M109A3 PLT (4 guns), no registration data available

FM: PLT ②

AFU; AMMO file

HEE   100

HEF   6

HEA   100

HER   30

**DETERMINE WHAT PROJECTILE
BCS WILL SELECT FOR FFE PHASE**

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FFE PROJECTILE SELECTION

EXAMPLE:

M109A3 PLT (4 guns), no registration data available

FM: PLT ②

AFU; AMMO file

HEE	100
HEF	6
HEA	100
HER	30

DETERMINE WHAT PROJECTILE BCS WILL SELECT FOR FFE PHASE

Solution: HEE
(HEF does not have sufficient quantity)

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AF PROJECTILE SELECTION

EXAMPLE:

M109A3 PLT (4 guns), no registration data available

FM: PLT ②

AFU; AMMO file

HEE   100

HEF   6

HEA   100

HER   30

DETERMINE WHAT PROJECTILE BCS WILL SELECT FOR AF PHASE

U
S
A
F
A
S

AF PROJECTILE SELECTION

EXAMPLE:

M109A3 PLT (4 guns), no registration data available

FM: PLT ②

AFU; AMMO file

HEE   100

HEF   6

HEA   100

HER   30

DETERMINE WHAT PROJECTILE BCS WILL SELECT FOR AF PHASE

Solution: HEA

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CHARGE SELECTION

p. 5-7

- **BCS selects the smallest charge from the selected propellant type that meets the trajectory requirement.**

- **BCS compares the COB to COT Range to the Corrected Maximum Range for the charge.**

- **BCS corrects the maximum range for the charge based on non-std conditions in the database.**

- **If the COB to COT Range is greater than 85% of the corrected maximum range than the BCS selects the next higher charge (low angle fire).**

- **If necessary, the BCS will change the selected propellant type.**

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BALLISTIC PROCESSING

p. 5-4

- **BALLISTIC SOLUTION ~>**

  (1) Applies MVVs from BCS; MVV if application criteria is met

  (2) Applies corrections for all other non-standard condtions in the database (met msg, ptemp, etc.)

  (3) Uses modified point-mass equation and other algorithims to determine Fire Commands

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BCS MVV APPLICATION

How FDO should apply MVVs:

- **Same gun**
- **Same proj family**
- **Same prop lot**
- **Same charge or to other charges according to an order of preference:**
  - » **Down 1 chg**
  - » **Up 1 Chg**
  - » **Down 2 chgs**
  - » **Up 2 chgs**
  - » **To any other prefered chg**
  - » **From a prefered to a restricted chg**

NEVER transfer a restricted chg!

How the BCS will apply MVVs:

- **Same gun**
- **Same proj family**
- **Same prop type**
- **Same charge or to other charges according to an order of preference:**
  - > **Down 1 chg**
  - > **Up 1 Chg**
  - > **Down 2 chgs**
  - > **Up 2 chgs**
  - > **Down 3 chgs**
  - > **Up 3 chgs**

BCS will transfer a restricted chg!

U S A F A S

SHEAF SELECTION

p. 5-8

- **Each howitzer's individual aiming point is based on the sheaf selected**

- **Entries in the SIZE, ATT, PTF, and SHEAF field determine which sheaf the BCS will select**

- **The BCS will select a default sheaf based on PTF:**
  - **1 howitzer in FFE = CONVERGED SHEAF**
  - **2 howitzers in FFE = OPEN SHEAF**
  - **3 or more howitzers in FFE = BCS SPCL CIRCULAR SHEAF**

- **EXCEPTIONS: If CPH, AML, AMS, APL, or APS is the shell to fire the BCS will always use a CONV SHEAF**

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Cycle of Messages

- **Fire Commands**
- **FM; MTO (If OBS is entered in FM;CFF)**
- **FM;FOCMD Messages**
    - **Shot**
    - **Splash**
    - **Ready**
    - **Rounds Complete**
- **Related Message Data**

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FM; MTO

p. 2-32

•**Computed by BCS if observer # entered in OBS/FST**

```
_____;P:_;SB:_/_/_/__/___;C:___;SG:__,__;DT:__,__/__/__;ID:____;A:_;
FM;MTO;OB: TGT:     ;KNPT: ;PER:23;ANGLET: 7 ;
ME:  / ;CONT:   /   ;MIS: ;OF:     ;FPF: ;CPRHD:R /7 / 5 ;
SHAJ:  ;FZE:    ;AUF: / / / / /   ;SHEF:  / ;FZ:  /   ;
UNITS: ;VOL: ;
```

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FM; SUBS

p. 2-39

- **Most fields are the same as FM; CFF**
- **BCS will assume previously entered values for most fields unless the operator enters new data**

```
FM;SUBS;TGT:AJ1234;CORD:        /         /        ;GZ:    ;
DIR:     /   ;DIST:       ;SHIFT: /     / /      / /        ;SHFCOR: ;
OBSN:          ;SIT:        ;TYPE:ARMOR /MDM    ;DISPO:     /      ;CAS:
EOM: ;RAT: ;CONT:WR   /AF   ;ME:LOW  /     ;UFFES:  /1/A/1 /51 ;PTM:
ASF:HEA/PDA ;SH:HEF/     ;FZ:TIB  /       ;RDS:12;
LOT:A/G;CHG:5;LOTS:F/G/ / ;CHGS:5/ ;FIRINT:     ;CMD:      ;SHEAF:
PTF:1G   ;SPTF: 1/    /    /     ;SHTF: / / / / / / / ;
PFFE:BTRY;SHFFE: / / / / / / / ;REP: ;ALT:        ;GTAZ:       ;GTRG:
ACORD:565065/03846654/ +390;AGZ:+14;
HOB:    0;RG:  7599;TOF:  27.7;MAXORD:  4348;
RARP: ;RATI: ;TIRPT: ;LOT2R: ;VOLCMD: ;CSLOAD: ;RPT: ;
```

BCS SPECIAL SITUATIONS

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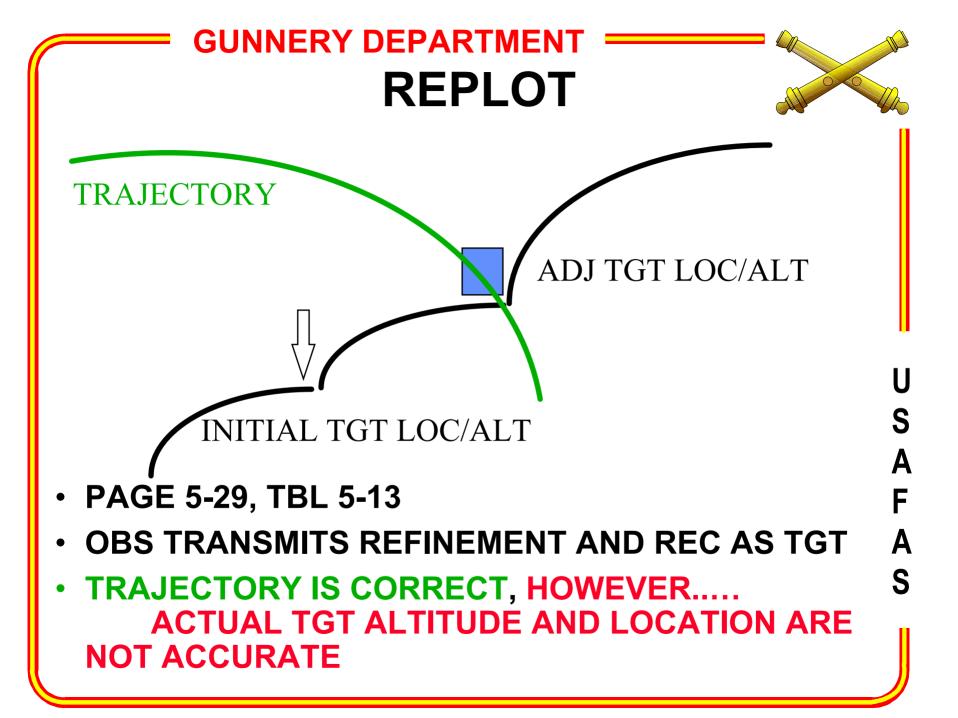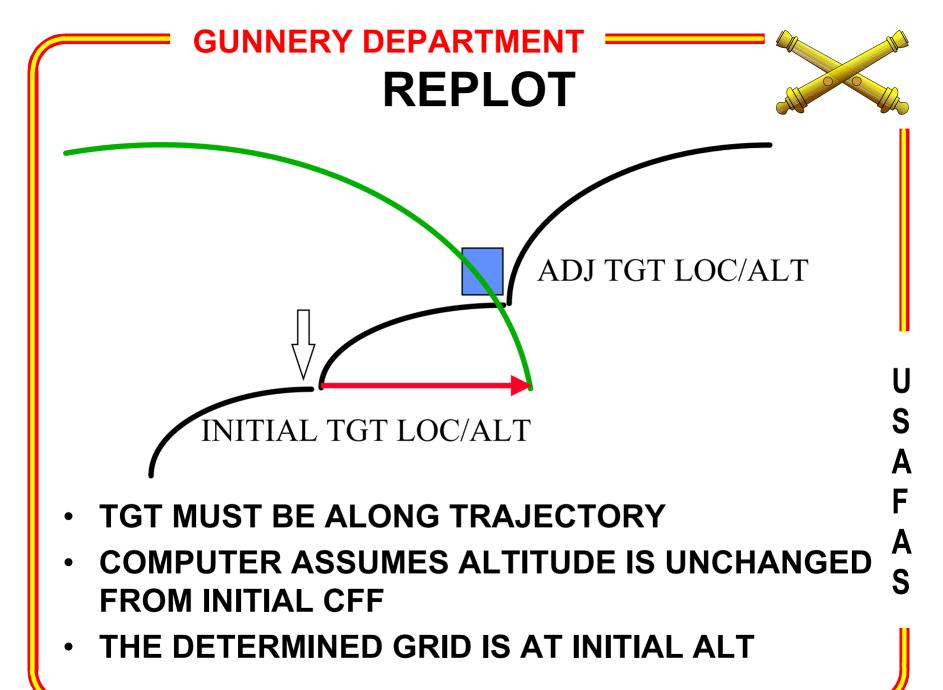S
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GFT SETTING / TGPC

p.5-67

- **BCS database stores non-std conditions, therefore the BCS applies non-std conditions to every fire mission**

- **Conduct Dry-Fire MSN using polar method of target location (with False observer at base piece location) and use the BCS solution to construct a GFT Setting for manual backup**

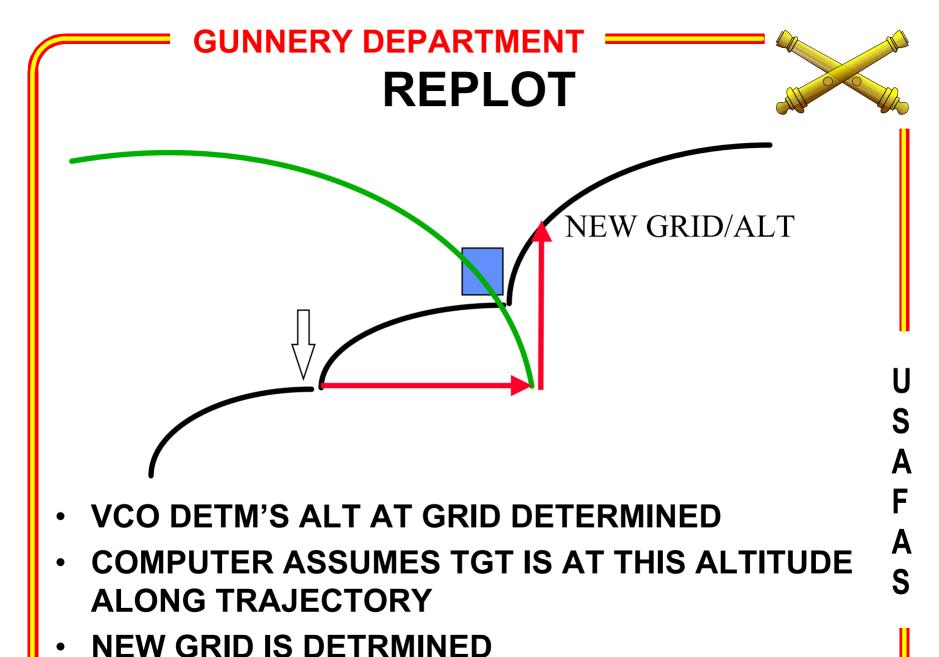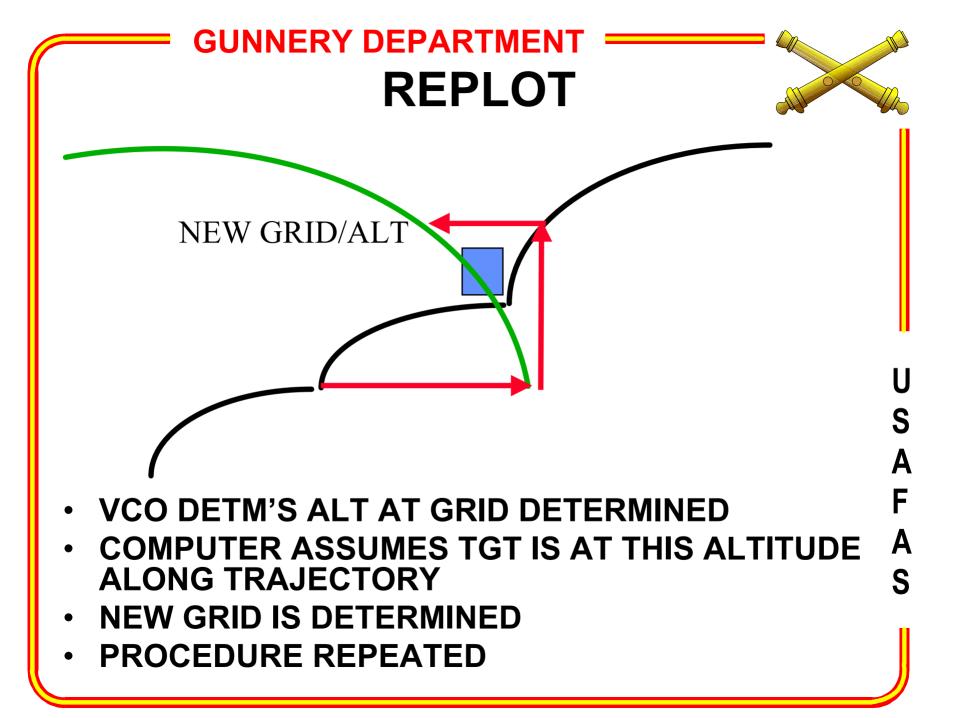- **Use AOF for Direction & usually a MET Check Gage Point for range.**

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p. 5-29

REPLOT

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REPLOT

TRAJECTORY

ADJ TGT LOC/ALT

INITIAL TGT LOC/ALT

- **PAGE 5-29, TBL 5-13**
- **OBS TRANSMITS REFINEMENT AND REC AS TGT**
- **TRAJECTORY IS CORRECT, HOWEVER..... ACTUAL TGT ALTITUDE AND LOCATION ARE NOT ACCURATE**

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REPLOT

ADJ TGT LOC/ALT

INITIAL TGT LOC/ALT

- **TGT MUST BE ALONG TRAJECTORY**
- **COMPUTER ASSUMES ALTITUDE IS UNCHANGED FROM INITIAL CFF**
- **THE DETERMINED GRID IS AT INITIAL ALT**

REPLOT

NEW GRID/ALT

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- **VCO DETM'S ALT AT GRID DETERMINED**
- **COMPUTER ASSUMES TGT IS AT THIS ALTITUDE ALONG TRAJECTORY**
- **NEW GRID IS DETRMINED**

REPLOT

NEW GRID/ALT

- **VCO DETM'S ALT AT GRID DETERMINED**
- **COMPUTER ASSUMES TGT IS AT THIS ALTITUDE ALONG TRAJECTORY**
- **NEW GRID IS DETERMINED**
- **PROCEDURE REPEATED**

REPLOT

FINAL GRID ALT

NEW GRID/ALT

- **REPLOT CONTINUES UNTIL A CONTOUR INTERVAL IS SPLIT**
- **GRID THEN DETERMINED IS ACCURATE**
- **PROCEDURES FUNCTIONS THROUGH SUCCESSIVE APPROXIMATION**

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ILLUMINATION

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FDC CONTROLLED COORDINATED ILLUMINATION

p. 5-84

- **THE OBSERVER WILL TRANSMIT COORDINATED ILLUM TO THE FDC**

- **THE OBSERVER WILL TRANSMIT ILLUMINATION MARK AT THE TIME THE TARGET IS BEST ILLUMINATED**

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FDC CONTROLLED COORDINATED ILLUMINATION

- **THE FDC TIMES THE INTERVAL BETWEEN ACTUAL FIRING OF ROUNDS AND TRANSMISSION OF ILLUMINATION MARK**

- **COMPARING THIS INTERVAL TO THE HE TOF, THE FDC CONTROLS FIRING SO HE ROUNDS IMPACT AT TIME OF MAXIMUM ILLUMINATION**

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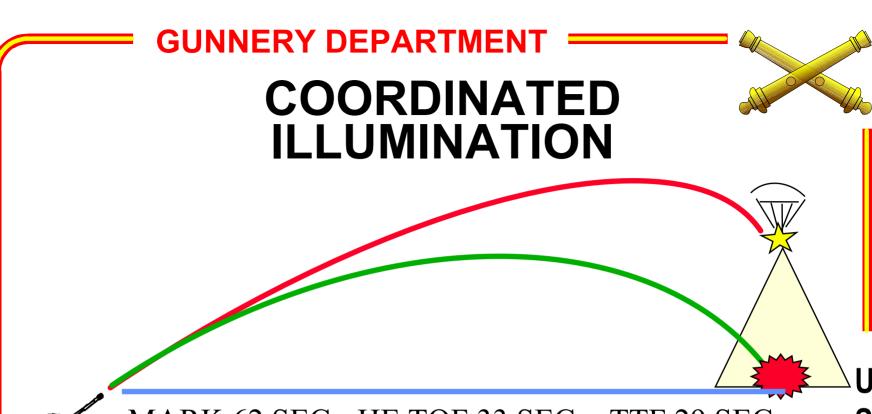F
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COORDINATED ILLUMINATION
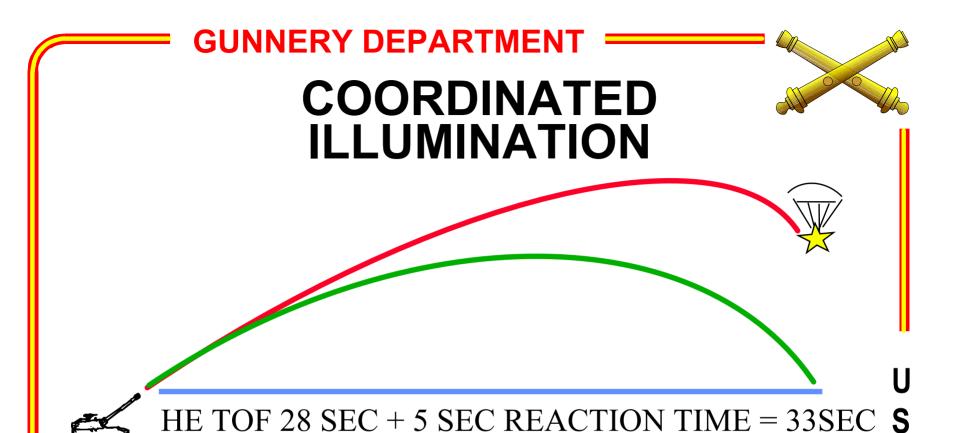
62 SECONDS FROM ILLUM SHOT TO MARK

- **FDC FIRES ILLUM AND STARTS TIMER**
- **OBS TRANSMITS "ILLUMINATION MARK" WHEN TGT AREA IS BEST ILLUMINATED**
- **TOTAL ELAPSED TIME IS MARK TIME**

USAFAS

COORDINATED ILLUMINATION

HE TOF 28 SEC + 5 SEC REACTION TIME = 33SEC

- **OBS TRANSMITS HE CALL FOR FIRE**
- **FDC DETERMINES HE TIME OF FLIGHT AND ADDS 5 SEC REACTION TIME**
- **FDC SUBTRACTS HE TOF + 5 SECS FROM MARK TIME TO DETERMINE TIME TO FIRE (TTF) HE**

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COORDINATED ILLUMINATION

MARK 62 SEC - HE TOF 33 SEC = TTF 29 SEC

- **FDC FIRES ILLUM, STARTS TIMER**
- **FDC FIRES HE AFTER DETERMINED AMOUNT OF TIME (TTF) HAS ELAPSED**
- **HE BURSTS UNDER OPTIMUM ILLUM**

U S A F A S

CONTINUOUS ILLUMINATION

- FDC WILL FIRE ILLUMINATION CONTINUOUSLY (RATE OF FIRE DEPENDS UPON PROJECTILE) WHILE THE OBSERVER ADJUSTS THE HE

- THIS METHOD EXPENDS A LARGE QUANTITY OF AMMO AND IS THE <u>LEAST DESIRABLE</u> METHOD

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LASER MISSIONS

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SIX TYPES OF LASER MISSIONS

- **STATIONARY TARGET**   **- STGT**
- **PREDICTED TARGET**   **- PRED**
- **DRAW TARGET**   **- DRAW/LAST**
- **RESECTION**   **- RESC**
- **TRILATERATION**   **- TRIL**
- **TRIANGULATION**   **- TRIANG**

U S A F A S

TRILATERATION MISSION

p. 5-35

- **THE <u>FIRST</u> POINT INPUT MUST BE ON THE OBSERVER'S <u>LEFT</u>**

- <u>TWO</u> KNOWN POINTS MUST BE RECORDED IN THE KN PT FILE AND <u>IDENTIFIED PRIOR</u> TO PROCESSING THE MISSION

- **THE BCU WILL USE THE OBSERVER-KNOWN POINT <u>DISTANCES</u> AND <u>VERTICAL ANGLES</u> TO DETERMINE THE OBSERVER'S LOCATION**

- THE BCU <u>DOES NOT</u> USE THE <u>AZIMUTH</u> THE OBSERVER SENDS; THEREFORE <u>DIRECTIONAL CONTROL</u> IS NOT REQUIRED

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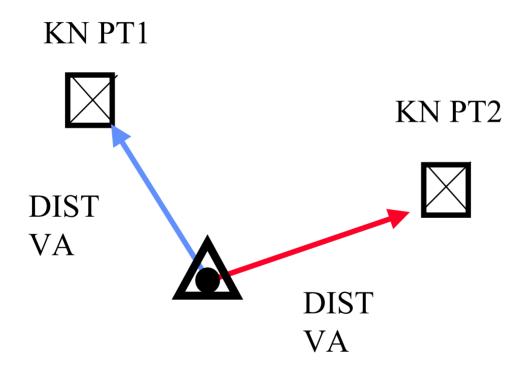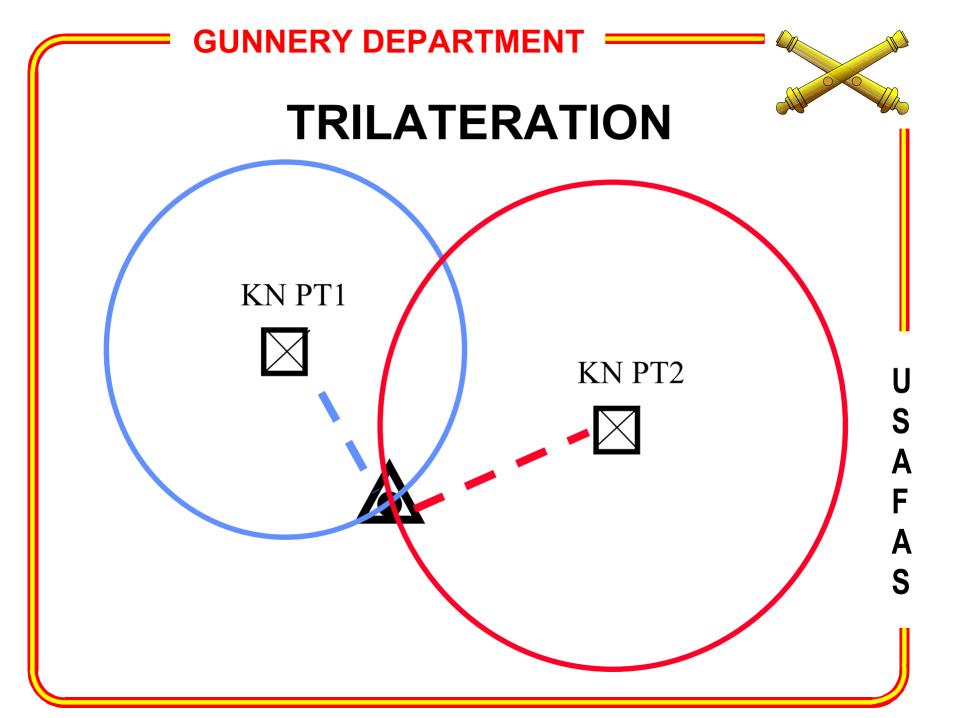# TRILATERATION

KN PT1

KN PT2

TRILATERATION

KN PT1

KN PT2

DIST
VA

TRILATERATION

KN PT1

KN PT2

DIST
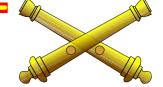VA

DIST
VA

TRILATERATION

KN PT1

KN PT2

USAFAS

TRILATERATION

- **FM;OBCO AUTOMATICALLY UPDATED/STORED IN DATABASE**

- **FM;OBCO DISPLAYED IS TRANSMITTED TO THE OBSERVER**

- **SYS;PTM WITH DIRECTION TO KN PT ON LEFT DISPLAYED FOR TRANSMISSION TO THE OBS**
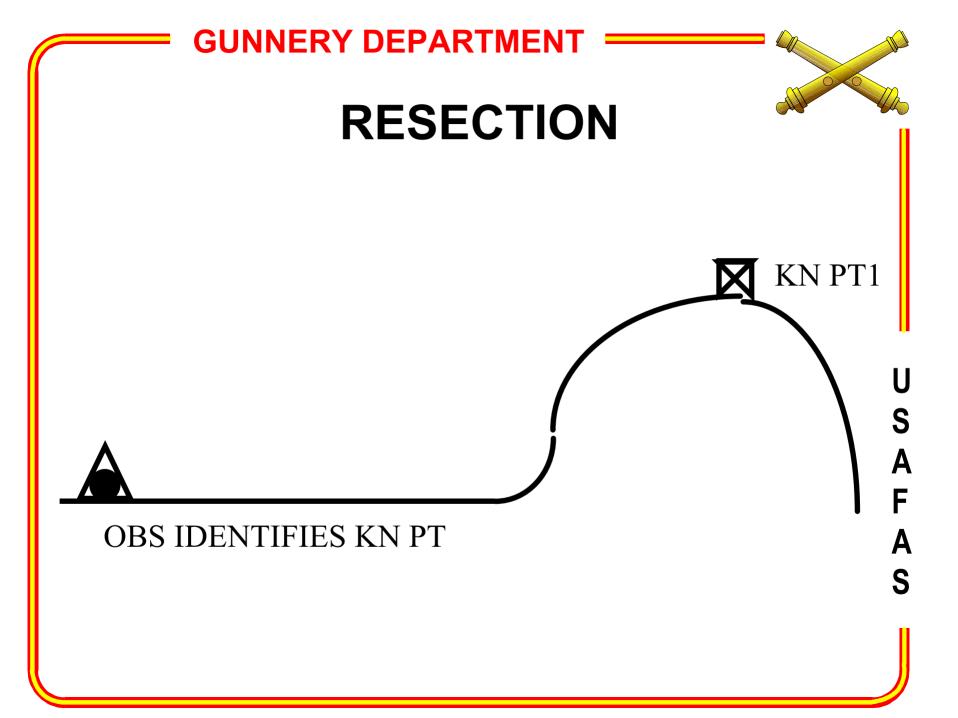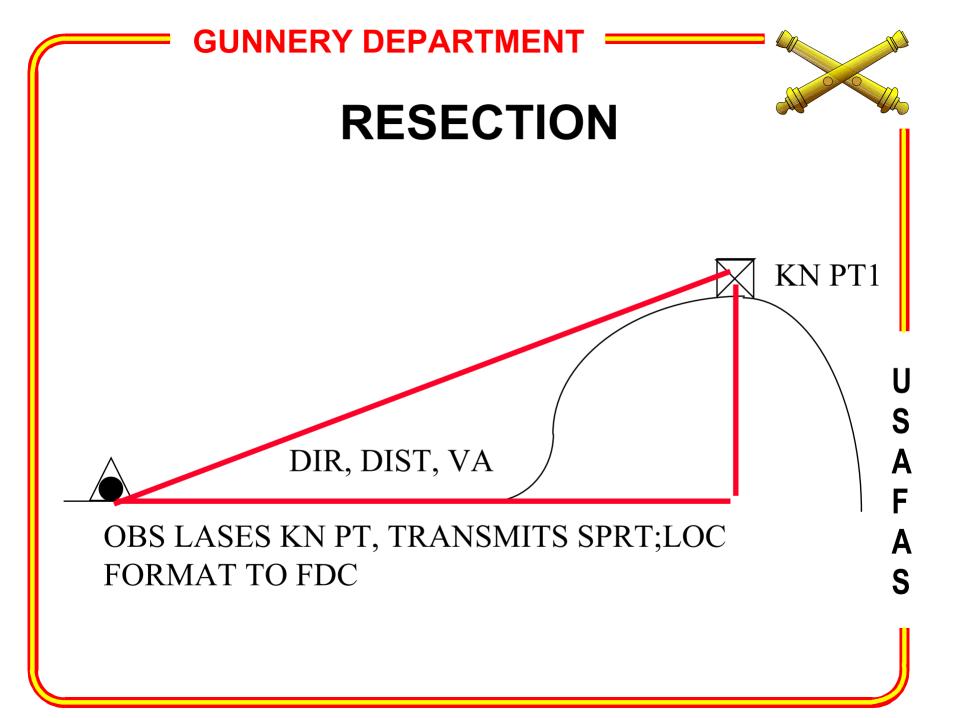
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RESECTION MISSION

p. 5-34

- <u>ONE</u> KNOWN POINT MUST BE RECORDED IN THE KN PT FILE AND IDENTIFIED <u>PRIOR</u> TO PROCESSING THE MISSION

- THE BCU WILL USE THE OBSERVER KNOWN POINT <u>DIRECTION, DISTANCE, AND VERTICAL ANGLE</u> TO DETERMINE THE OBSERVER'S LOCATION

- THE OBSERVER <u>MUST</u> HAVE <u>DIRECTIONAL CONTROL</u>

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RESECTION

KN PT1

OBS IDENTIFIES KN PT

RESECTION

KN PT1

DIR, DIST, VA

OBS LASES KN PT, TRANSMITS SPRT;LOC
FORMAT TO FDC

U
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RESECTION

KN PT1

INVERSE
DIR, DIST, VA

DIR, DIST, VA

BCS DETERMINES AND USES INVERSE DIR, DIST, AND VA TO LOCATE OBS.

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RESECTION

- **BCS STORES/UPDATES FM;OBCO FOR OBSERVER**

- **BCS DISPLAYS FM;OBCO FOR TRANSMISSION TO OBS**

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TRIANGULATION

p. 5-37

- **OBS LASES KN PT ON LEFT**

- **OBS LASES KN PT ON RIGHT**

- **BCS USES DIRECTION <u>ONLY</u> TO DETERMINE OBS LOCATION**
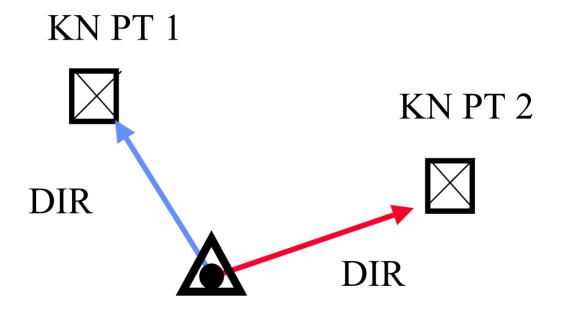
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TRIANGULATION

KN PT 1

KN PT 2

DIR

TRIANGULATION

- **BCS STORES /UPDATES FM;OBCO FOR OBSERVER**

- **BCS DISPLAYS FM;OBCO FOR TRANSMISSION TO OBSERVER**

- **BCS DISPLAYS 'WARNING - VERIFY ALTITUDE WITH MAP SPOT'**

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STGT TARGET MISSION

p. 5-31

- THE OBSERVER LASES THE <u>TARGET</u>, AND AN ADJUSTING ROUND IS FIRED

- THE OBSERVER THEN LASES THE <u>BURST</u> OF THE ADJUSTING ROUND

- THE BCU WILL COMPARE THE LASINGS OF THE <u>TARGET</u> AND THE <u>BURST</u>, AND DETERMINE A CORRECTION TO MOVE THE NEXT ROUND TO THE TARGET

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PREDICTED POINT

p. 5-33

- **OBSERVER LASES A POINT WHICH THE TARGET IS <u>EXPECTED TO MOVE</u>**

- **THE MISSION IS REQUESTED AS AN <u>AMC FFE</u> MISSION**

- **THE OBSERVER CONTROLS THE FIRING TO ENSURE THE <u>SIMULTANEOUS</u> ARRIVAL OF THE <u>TARGET</u> AND <u>PROJECTILE</u> AT THE <u>PREDICTED POINT</u>**

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LASER DRAW MISSION

p. 5-32
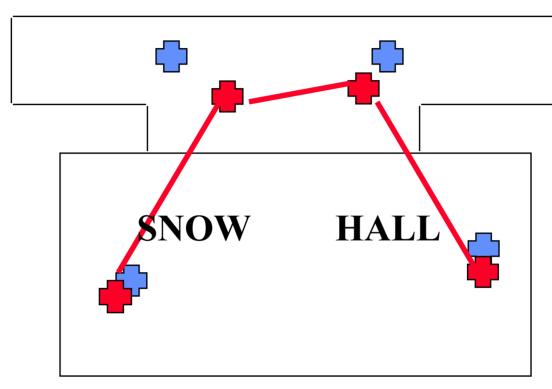
- **THE OBSERVER IDENTIFIES AN IRREGULAR SHAPED TARGET BY LASING <u>2</u> TO <u>8</u> POINTS**

- **THE LAST POINT MUST BE IDENTIFIED WITH <u>LAST</u> IN THE <u>LAS</u> FIELD TO GENERATE FIRE COMMANDS.**

- **REQUIRES THE BCU TO HAVE AT LEAST <u>3</u> GUNS IN BCS; PIECES OPERATIONAL**

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BCS PRIORITY MISSIONS

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BCS PRIORITY MISSIONS

p. 5-91

- BCS CAN STORE 2 PRIORITY MISSIONS, ONE EACH IN MISSION BUFFERS 4 OR 5.

BCS CAN ASSIGN EITHER:

- ONE FPF AND ONE PRIORITY COPPERHEAD MISSION TO MISSION BUFFER 4 & 5.

- OR TWO COPPERHEAD MISSIONS TO MISSION BUFFERS 4 & 5.

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FINAL PROTECTIVE FIRE

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FPFs

- **All guns are layed on FPF data when not firing**

- **Adjusted FPF vs. Non-adjusted FPF**

- **FPF Sheafs**
  - **Wall of Steel: do not leave holes in the wall**
  - **Linear sheaf: length is based on burst width**
  - **Laser Draw: traces actual terrain**
- **Entered w/ FM; CFF > "X" in ASNFPF field**

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M712 COPPERHEAD

USAFAS

COPPERHEAD MISSION PROCESSING (CON'T)

- THE TOTAL NUMBER OF ROUNDS FIRED WILL NOT BE GREATER THAN <u>SIX</u> AND THE MAXIMUM NUMBER OF HOWITZERS ASSIGNED TO THE MISSION WILL BE <u>TWO</u>

- ASSIGNMENT OF SPECIFIC HOWITZERS TO FIRE IS BASED ON COMMUNICATION STATUS CODE IN BCS; PIECES ("C" or "W")

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FIRING PRIORITY MISSIONS

p. 5-93 thru 5-100

- **A PRIORITY MISSION CAN BE FIRED BY:**
  - **AN OBSERVER USING AN FM;QF (REMOTE)**
    - » **FPF > "X" in FPF field**
    - » **CPHD > "X' in FIRE and CPHD fields**
  - **BCU OPERATOR USING THE FPF KEY (LOCAL)**

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FIRE PLANS

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FIRE PLANS

p. 5-100

- **FASCAM TARGET AIM POINTS CAN BE STORED IN ALL FOUR OF THE FIRE PLANS**

- **CAN BE INPUT LOCALLY AS INDIVIDUAL TGTS (NNFP;CFF:)**

- **CAN BE TRANSMITTED TO BCS AND ENTERED AS A GROUP (MAIN INDEX, 8, RETURN)**

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FIRE PLAN SILVER

PLAN: SILVER   H-HOUR: ON-CALL

TGT	H	VOL	SH/FZ	PTF	CORD/ALT/GZ
BC1001	-7	2	HE/VT	BTRY	142/513 465 +33
BC1002	-3	4	HE/VT	BTRY	144/514 465 +33
BC1006	H	1	WP/Q	BTRY	139/519 430 +33
BC1108	+2	1	ICM	BTRY	138/524 445 +33
BC1011	+5	1	ICM	BTRY	137/520 430 +33

USAFAS

UPDATING/CHANGING FIRE PLANS

p. 5-102

- **TO SET OR CHANGE H-HOUR, AND DELETE TARGETS OR FIRE PLANS USE THE BCS;COMD FORMAT**

- **TO FIRE A TARGET BEFORE H-HOUR, PLACE AN "X" IN FR:__ FIELD OF NNFP;CFF AND EXECUTE**

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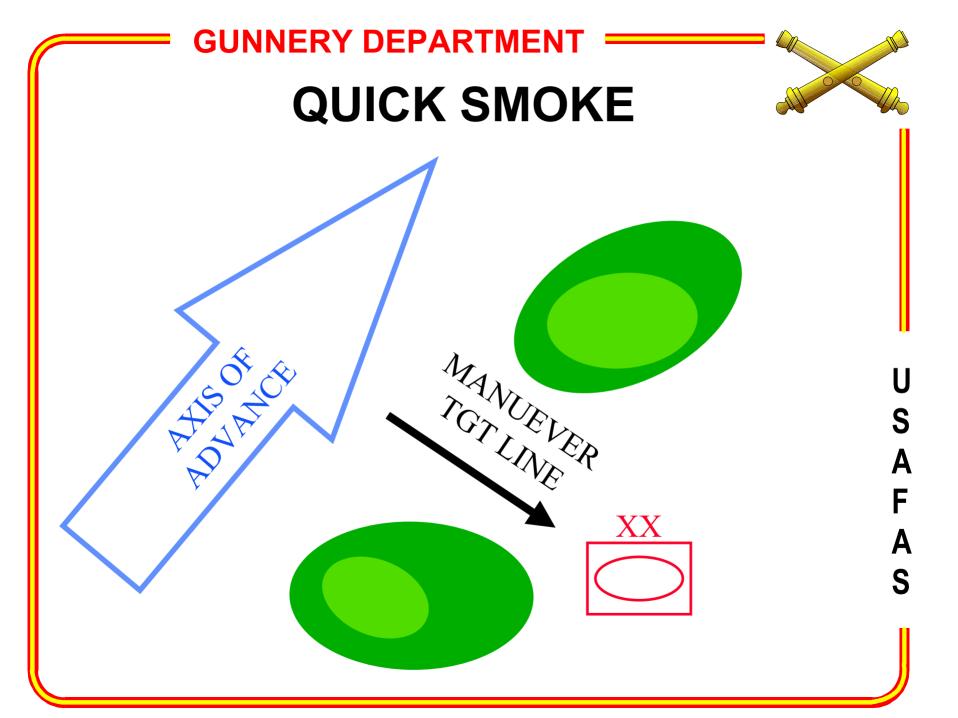F
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EXECUTION of FIRE PLANS

p. 5-103

- **FM;CFF:O GENERATED 10 MINUTES BEFORE TIME TO FIRE**

  – **TIME TO FIRE EQUALS H-HOUR PLUS H, MINUS TIME OF FLIGHT PLUS 5 SECOND REACTION TIME**

- **FM;CFF:O PLACED IN INPUT QUEUE FOR OPERATOR EXECUTION, PROCESSING, AND FIRING**
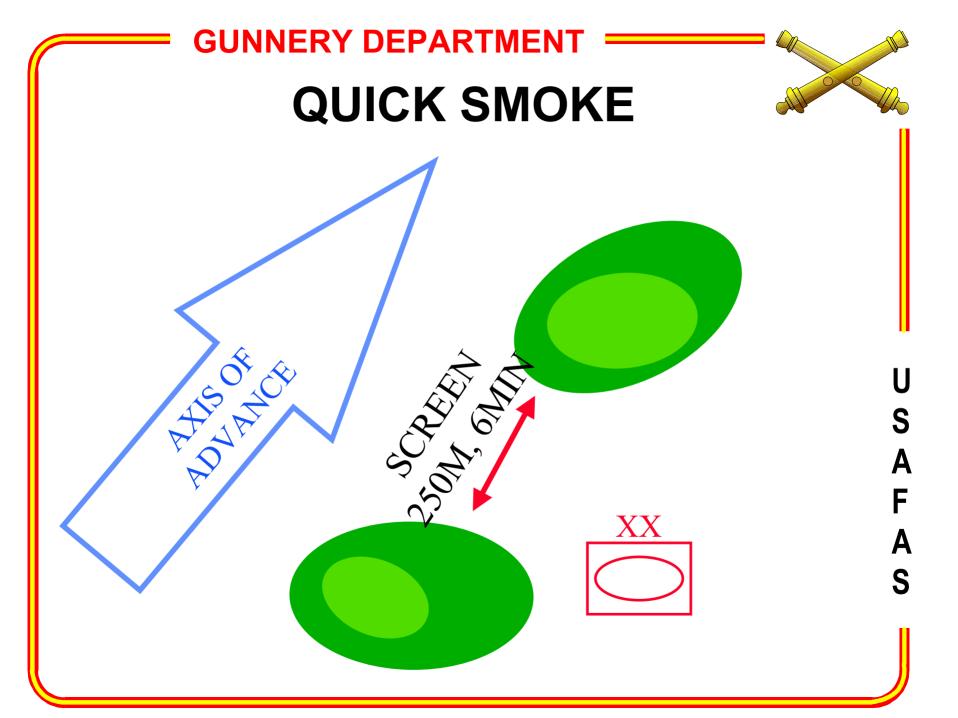
- **CYCLE THROUGH ALL PLANNED TARGETS IN THIS MANNER**

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QUICK SMOKE

QUICK SMOKE

AXIS OF ADVANCE

MANUEVER TGT LINE

XX

USAFAS

QUICK SMOKE

AXIS OF ADVANCE

SCREEN 250M, 6MIN

XX

U S A F A S

QUICK SMOKE

p. 5-88

- **OBSERVER TRANSMITS CFF IN THE FORM OF LMDIRT-**
  – **LENGTH OF SCREEN**
  – **MANUEVER-TGT DIRECTION**
  – **DIRECTION OF WIND**
  – **DURATION OF SCREEN**
- **FDO DETERMINES FIRE ORDER**
- **FDC DETERMINES FIRING DATA**

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CALL FOR FIRE

F21 de H55 FFE $_K$

GRID 1450 4670 EST ALT 450$_K$

  SCREEN MOVEMENT 250 M, DIR 1950,TAIL, 6MIN$_K$

$_K$

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FDC DETERMINES

- **RELATIVE HUMIDITY 50%**
- **WINDSPEED LINE 00 16 KNOTS**
- **LOCATION - GERMANY**
- **CURRENT CLOUD COVER - CLOUDY**
- **TEMPERATURE OUTSIDE - WARM**

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M825 SMOKE FIRE ORDER

PASQUILL CATEGORY   **D**

SMOKE TABLE   **D - 9**

WINDSPEED   **16**

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FROM SMOKE TABLE

R1   4
                            _____
R2   2
                            _____
FIRE INTERVAL   1.5
                            _____

NUMBER OF VOLLEYS TO FIRE

$$\frac{\text{SMOKE DURATION}}{\text{FIRE INTERVAL}} = \frac{\text{TOTAL NUMBER}}{\text{OF VOLLEYS}}$$

$$\frac{6}{1.5} = 4$$

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WHO WILL FIRE?

	LEFT PLT	RIGHT PLT	
	X X	X X	R1
		X X	R2
		X X	R2
		X X	R2
			R2

U S A F A S

FIRE ORDER

RIGHT PLT 4 RDS, LEFT PLT 1 RD, BRAMC, SH M825

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FIRE CONTROL INFORMATION CORRECTION

- **FFE**
  - **RANGES LESS THAN 10K ADD 50M TO TGT ALT**
  - **RANGES GREATER THAN 10K ADD 100M TO TGT ALT**
- **AF**
  - **RANGES LESS THAN 10K UP 50M PRIOR TO FIRING M825**
  - **RANGES GREATER THAN 10K UP 100M PRIOR TO FIRING M825**

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CONDUCT OF PE

- **Known data HO on page 113 of OAC phasebook**
- **Blank message formats on page 125**
- **SQUARE PAGE 128 #9.a. CHANGE PROP TEMP TO 90 DEGREES**
- **Highlight default values and required entries**
- **Answer key in back of room**
- **FT Sill map in back of room**
- **Shutdown before leaving (save DB if needed)**
- **You can leave when you're finished!**

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